**Motivation.**
To provide a regional (Land/Ocean) Northern Hemisphere jet stream analysis using one method to define the jet stream, and the 20CR reanalysis data from 1871-2011, the longest available dataset (Compo et al., 2011).

**Methodology.**
Jet speed was defined as the maximum absolute wind speed $U$, based on the 250mb 6-hourly zonal and meridional wind velocity at each longitude ($2^\circ$ resolution).

$$D = \frac{1}{N} \sum_{n=1}^{N} \left( u_n^2 + v_n^2 \right)^{3/2}$$

where $n = 1, \ldots, N$ ensemble members.

Jet latitude was defined as the latitude of maximum jet speed.

**Seasonal Jet Latitude Variability**
Seasonally the jet latitude range is lower over the oceans compared to land from 20° over Eurasia to 10° over the North Atlantic where the ocean meridional heat transport is greatest.

**Results**

**Decadal Trends**

- Significant increases in jet latitude are seen in all seasons in the North Atlantic with an increase of $3^\circ$N (0.2°/decade) in winter. The increase in jet latitude is consistent with the decreasing temperature gradient between the pole and equator at the tropopause.
- No significant changes in jet latitude are seen over the North Pacific.
- Significant increases in jet speed are found in all seasons over the North Atlantic up to 4.5m/s (0.3ms-1/decade) in winter. The increases in jet speed are consistent with the increased 300mb geopotential height gradient between the poles and the equator.
- The North Pacific region has no significant change in jet speed.

**Interannual Variability**
In the North Pacific 20-year variability in jet latitude and jet speed are seen (Fig. 4), associated with the Pacific Decadal Oscillation (PDO) which explains 50% of the winter variance in jet latitude since 1940. The direction of the arrows indicates the PDO and jet stream are anti correlated, and the PDO leads.

+PDO (-PDO) phase leads to increase (decrease) in meridional temp gradient, with warm (cold) anomaly south and cold (warm) anomaly north, associated with a southward (northward) shift in jet stream.

**Summary and ongoing work:** Regional (land-ocean) differences in jet latitude and speed are seen from seasonal to decadal timescales, with increasing trends in jet latitude and jet speed over the Northern Atlantic but not over the North Pacific. Over the North Pacific jet latitude and speed variability is associated with PDO variability. Ongoing work as part of the ROADMAP project is looking to understand in more detail how ocean variability in the North Atlantic and North Pacific modulates jet stream behaviour.

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**Further reading:** Hallam S, Josey SA, McCarthy G, Hirschi JIM (2022) A regional(land-ocean) comparison of the seasonal to decadal variability of the Northern Hemisphere jet stream. Climate Dynamics (accepted) pre-print DOI: https://doi.org/10.21203/rs.3.rs-607067/v1